Rehabilitation Following Rotator Cuff Repair

Why One Rehab Program Doesn’t Work for All Patients

REHABILITATION FOLLOWING ROTATOR CUFF REPAIR

Introduction

Have different rehab programs for specific patients & surgeons
“One size does not fit all”
✓ Rehab based on surgery & patient
✓ Size of the tear
✓ Tissue quality
✓ Type of repair
✓ Patient variables
✓ Multiple programs – “several programs

Specific & Adjustable Rehab Programs

Rehab Following Rotator Cuff Repair Surgery

Points of Discussion

✓ Motion is Good for Joints !
✓ Rehabilitation program is based patient variables (tear size & tissue quality) & surgery variables
✓ Discuss key points
✓ Immediate passive motion (often but not always !)
✓ Control forces on repair site
✓ Gradual stress to healing tissue
Rehab Following Rotator Cuff Repair Surgery
Points of Discussion

- Rehabilitation philosophy
- Early motion vs. delayed motion
- Individualize rehabilitation programs
- Muscle training & function

Do Not Want Early Strengthening - Rather Activation & GH Stability/Control

Rehabilitation Following Cuff Repair
Maximizing Tendon Healing

Biomechanical Factors

Biologic Factors

Patient Factors

Effect of Smoking on Rotator Cuff Repairs
Mallon et al. JSES 2004

51% vs 15%

Rehabilitation Following Rotator Cuff Repair
Introduction

What’s the concern about early motion?

Failure of the Repair !!!

REHABILITATION FOLLOWING ROTATOR CUFF REPAIR
Introduction – Failure Rates

How do you determine failure ??

Boileau: JBJS ’05 (~29%) failure rate
- 93% satisfied with the result at 2 yrs

Sugaya: Arthroscopy ’03 (~40%) in large to massive size tears (MRI)
- Almost all have sign improvement in symptoms

Galatz: JBJS ’04 (~94%) large to massive tears
16/18 (89%) had functional double

Harryman JBJS ’91 – recurrent defect in ~50% of 2 tendon tears
- 87% good to excellent results at 3 yrs post-op
Miller et al: AJSM ‘11

- When do RTC repairs fail? Serial US exam after large RTC tears
- 22 patients with large or massive tears (>3 cm) standardized arthroscopic repair (mean age 62.7 yrs)
- Serial US performed at 2 days, 2wks, 6 wks, 3 mos, 6 mos & 1 yr
- *4 weeks of immobilization, strengthening at 12 wks
  - 9 of 22 (41%) demonstrated recurrent tears
  - 6 re-tears (66%) occurred within 69 days
  - 3 re-tears (33%) occurred after 178 days
  - *2 tears occurred during first 30 days (immob.) & 5 of 9 tears occurred within first 51 days

Harryman et al, JBJS ‘91

- Correlated functional ability with operative repairs of RTC
- Follow-up 5 years, ultrasound evaluation
- 80% repairs intact; if only supraspinatus
- 57% repairs intact; if two tendons repaired
- PROM – 8 wks, no strengthening 12 wks
- 67% satisfactory results & outcomes

Gimbel et al: J Biomech Eng ‘07

- Animal studies
- Some studies less stiffness with longer periods of immobilization

Peltz et al: JBJS ‘09

- Have different rehab programs for specific patients & surgeons
  - “One size does not fit all”
  - Rehab based on surgery & patient
  - Size of the tear
  - Tissue quality
  - Type of repair
  - Try to individualize
  - Multiple programs – 3 programs

Specific & Adjustable Rehab Programs
REHABILITATION FOLLOWING ROTATOR CUFF REPAIR

Three Distinct Programs
Arthroscopic Procedures

- Type I: small tears (1cm or<) (very good tissue quality)
  » Abduct sling 4 weeks, Full AROM 6-8 weeks
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- Type III: large - massive tear (4cm >)
  (poor tissue, retracted tissue, tenuous repairs)
  » Abduct sling 4-6 wks., Full ROM 12-16 wks

Motion is Good for Joints'

- Motion helps:
  ✓ Reduce pain
  ✓ Reduce the need for pain medication
  ✓ Nourish articular surfaces
  ✓ Promote collagen synthesis
  ✓ Align collagen
  ✓ Engages the patient in the rehab process

Passive Motion vs. Active Motion

Rehab Following Rotator Cuff Repair

My Message: Motion is Good

- Limited controlled motion is safe for the appropriate patients
- Motion is good for healing tissue
- Immobilization is potential detrimental for articular cartilage, tendons, ligaments & for collagen synthesis & organization collagen
- RTC repair rehab programs are an equation!

Correct patient, tissue, surgery technique, & rehab

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Passive Motion vs. Active Motion

Rehab Following Rotator Cuff Repair

Motion

Some people say cuff repairs don’t get stiff

Rotator Cuff Repairs & Stiffness

8 weeks post-op massive cuff chronic repair

Rehab Following Rotator Cuff Repair

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Rehab Following Rotator Cuff Repair

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Rotator Cuff Repairs & Stiffness

8 weeks post-op massive cuff chronic repair
Rehab Following Rotator Cuff Repair

Motion

• Approximately 5 -16% of all patients will develop stiffness after rotator cuff repair

Koo et al: Arthroscopy 2011
Huberty et al: Arthroscopy 2009
Chang et al: Arthroscopy 2013
Harris et al: Orthopedics 2013
Franceschi et al: Sports Med Arthroscopy '11
Brislin et al: Arthroscopy 2007

Is this Acceptable to the Clinician?
Risk Factors for Developing Post-Op Stiffness:

- Calcific tendinitis
- Adhesive capsulitis
- PASTA type repair
- Concomitant SLAP repair
- Single tendon repair

Rehabilitation Following RTC Repair Surgery

- Post-operative rehab program is critical to the successful outcome following rotator cuff repair surgery
- Stiffness – common complication
  - Temptation to initiate active motion &/or strengthening too early – may result re-tears
- Re-tears is a more critical issue

Parsons, Gruson, Gladstone, Flathow: JSES ‘10

- 43 patients retrospective study conservative rehab and outcomes at 6 mos & 1 yr
- Sling for 6 weeks (full time) no rehab
  - Failures (MRI): Stiff group (N=10, 23%) 30% failure
    - Non-stiff group (N=33, 77%) 64% failure
  - What was stiff? (at 6-8 weeks)
    - 30 deg or < of ER
    - 100 deg or < of flexion
  - No difference in ROM, pain & ASES scores at 1 year (stiff exhibited better)
Koo, Parsley, Burkhart, Schoolfield: Arthroscopy ’11

- Benefits of a modified rehabilitation program in reducing post-operative stiffness
- 152 patients underwent arthroscopic cuff repair
- 79 patients were identified as at least 1 risk factor for stiffness
  - “Early overhead closed chain passive motion was added to a conservative rehab program” (table slide)
  - No patients developed post-op stiffness in modified grp
  - Compared to historical control 13% stiffness
- Level IV Evidence

Lastayo et al: JBJS ’98

- Prospective randomized study (N=32)
- Randomly assigned to 2 groups:
  - A: CPM immediately (N=17)
  - B: manual PROM (N=15)
- Shoulder Pain & Disability Index
- Both groups resulted in extremely successful
  - 84% excellent results, 6% good results, fair 7% & poor results 3%...no sign diff between groups... “motion yields favorable results...”

Kim, Chung, Kim, et al: AJSM ’12

- 105 consecutive patients undergoing arthroscopic repair of small & medium size tears
- Randomly assigned to one of two groups:
  - Early motion (3-4x day)
  - No passive motion for 4 wks small, 5 wks med.
- Shoulder Pain & Disability Index
- Both groups resulted in extremely successful
  - No difference in ROM , early motion no negative effect on cuff repair healing

Klintberg et al: Clin Rehabil ’09

- Prospective randomized study (N=14)
- Randomly assigned to 2 groups:
  - I: dynamic stabilization & PROM day 1
  - II: PROM immediately no cuff loading 6 wks
- Evaluated the patients at 3, 6, 12 & 24 mos.
- Pain, VAS, PROM, Strength, Funct Index
  - Early loading group better at 3 & 6 months (S) & slightly better for ROM, VAS, & strength at 24 mos (NS)

Duzgun et al: Acta Orthop Traumatol Tur ’11

- Prospective randomized study (N=29)
- Randomly assigned to 2 groups:
  - A: Accelerated rehab (N=13)
  - B: slow protocol rehab (N=16)
- Evaluated pain, DASH & functional activity
  - No sign diff between groups pain
  - Accelerated group was superior to slower group regarding functional activities, DASH scores at 8,12 & 16 weeks
REHABILITATION FOLLOWING ROTATOR CUFF REPAIR

Introduction

JOSPT '09

Open, Mini-open, and All-Arthroscopic Rotator Cuff Repair Surgery: Indications and Implications for Rehabilitation

Develop a Proper Treatment Plan

“Road map to treatment & success”
- Operative report
- Discussion of specifics with Surgeon
- Communications is a key
- Team approach

REHABILITATION FOLLOWING ROTATOR CUFF REPAIR

Keys to Success

Know what you’re treating

“not all patients are the same”
- Tissue quality
- Size of the tear
- Type of surgery (repair)
- Concomitant surgeries
- Patient variables (age, smokers)
- Work activities & desired goals
- Communication is key

Specific Rehabilitation Program

REHABILITATION FOLLOWING ROTATOR CUFF REPAIR

Keys to Success

Know what you’re treating

“how was the cuff repaired”

Factors Influencing Rehabilitation

- Type of repair: open, mini-open or arthroscopic surgical technique
- Fixation method: single row, double row, suture bridge technique, augmentation
- Patient’s tissue quality: musculotendinous, osseous
- Size & Location of tear: absolute size, number of tendons
- Type of tear: Horizontal, vertical, combination

Complex Suture Bridge Technique
Which method of RTC repair leads to highest rate of structural healing? Review:

- 1253 repairs from 23 studies
- Significantly lower retear rates in Double Row vs Single Row, Transosseous repair
- TO & SR retear rates 17% to 69% for tears less than 1cm to 5cm respectfully
- DR retear rates: 1cm 7%, 41% for 5cm+

### Rotator Cuff Repair
**Adjust Rehab based on Tissue Quality**

### REHABILITATION FOLLOWING ROTATOR CUFF REPAIR

**Factors Influencing Rehabilitation**

- Chronicity of tear/repair: acute - chronic
- Surrounding tissue quality:
  - subscapularis - posterior cuff
  - anterior deltoid - posterior cuff
- Patient variables: Not age but activity level, motivation, general health, smokers, etc.
  - Rehabilitation potential: independent-supervised
  - Physician’s philosophical approach:

### REHABILITATION FOLLOWING ROTATOR CUFF REPAIR

**Introduction — Failure Rates**

- Risk factors for recurrent tears:
  - Size of Tear
  - Ide: Arthroscopy '05
  - Sugaya: JBJS '07
  - Verma: Arthroscopy '06
  - Age of Patient
  - Boileau: JBJS '05
  - Liem: JBJS '07
  - Gil: Knee Surg Sports '03
- Occupation
  - Gazielly: Rev Chir Orthop Repar '95
- Tissue Quality & Early activities — aggressiveness, smokers

### REHABILITATION FOLLOWING ROTATOR CUFF REPAIR

**Keys to Success**

- Have different rehab programs for specific patients & surgeons
  - “One size does not fit all”
  - Rehab based on surgery & patient
  - Size of the tear
  - Tissue quality
  - Type of repair
  - Try to individualize
  - Multiple programs

### REHABILITATION FOLLOWING ROTATOR CUFF REPAIR

**7 Types of Rehabilitation Programs**

- Type I: Small tears — excellent tissue quality
- Type II: Medium –Large tears — good tissue
- Type III: Large – massive tears — poor tissue
- Arthroscopic type I: small to medium tears
- Arthroscopic type II: medium to large tears
- Arthroscopic type III: large to massive tears
- Arthroscopic Repair in overhead athletes

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**REHABILITATION FOLLOWING ROTATOR CUFF REPAIR**

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**REHABILITATION FOLLOWING ROTATOR CUFF REPAIR**

*Three Distinct Programs*

*Arthroscopic Procedures*

- **Type I**: small tears (1cm or <) (very good tissue quality)
  - Abduct sling 4 weeks, Full AROM 4-8 weeks
- **Type II**: medium - large tears (2-4 cm) (adequate tissue)
  - Abduct sling 4-6 weeks, Full AROM 8-12 weeks
- **Type III**: large - massive tear (4cm >)
  - (poor tissue, retracted tears, tenuous repair)
  - Abduct sling 4-6 wks., Full ROM 12-16wks

*Mini-Open Procedure*

- **Type I**: small tears (very good tissue quality)
  - Sling 7-10 days, Full AROM 4-6 weeks
- **Type II**: medium - large tears (adequate tissue)
  - Sling 4-6 weeks, Full AROM 8-12 weeks
- **Type III**: large - massive tear (poor tissue, tenuous repair)
  - Pillow splint 45 or 30 deg. 4-6 wks, Full AROM 12-16wks

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**Rehab Following Cuff Repair**

*Overview Rehab Guidelines*

- **Slow Rehab Approach**
  - Large-Massive tears
  - Poor tissue quality
  - Retracted tear, tension
  - Chronic tears
  - Smokers, health issue
  - Poor healing?
  - Single row fixation

- **Faster Rehab Approach**
  - Small – Medium tears
  - Good – excellent tissue
  - Single event
  - Younger patients
  - Excellent healing potential
  - Suture bridge fixation

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**Different Protocols to Match Different Patients**

*Treatment Concept #1*

- Individualize ❯ Classification Scheme
Fatty Atrophy/Infiltrate

- Mild, Moderate, Severe
- Streaks of high signal on T1
- Loss of muscle bulk (Sagittal)

Classification (Prognosis)

Tear
- Size: Number of Tendons vs Size of Tear (cm)
- Thickness: Partial or Full
- Timing: Acute or Chronic

Muscle Quality – Goutallier Classification
- Stage 0 - Normal muscle
- Stage 1 - Some fatty streaks
- Stage 2 - More muscle than fat
- Stage 3 – 50/50 fat and muscle
- Stage 4 - More fat than muscle is present

Costouros…Warner: Arthroscopy ‘07

- 26 of 216 patients treated for RTC tear – identified as massive
- EMG & NCV performed pre & post-operatively
- 14 of 26 (54%) identified with peripheral nerve injury
  (7 suprascapular n, 4 axillary n, 2 upper trunk brachial plexus, 1 C spine)

REHABILITATION FOLLOWING ROTATOR CUFF REPAIR

Keys to Success
- Protection is Important/Imperative
  “When in doubt go slow”
  ✓ PROM places strain on cuff repair
  ✓ Active muscle contraction places strain on cuff repair
  ✓ Active functional motions - strain
  ✓ Abduction braces/slings may help
  ✓ Multiple programs

Team Approach to Treatment - Individualize

Arthroscopic Rotator Cuff Repair

Rehabilitation Program

Post-Operative Braces/Slings

Is Bigger Better?

PROM Progression

PROM Progression Based on Progress & End Feel

30/45 deg abd → 90 deg abd → 0 deg
Rehabilitation Following Cuff Repair

*Shoulder Brace - Pillow*

**Hatakeyama: AJSM '01**

- Rotator cuff strain less at 30° & 45°
- Sign increase in strain from 30° to 15° & 15° to 0°

30 degree Pillow brace – decreases cuff strain

**Park, Jun, El Attrache, Lee: AJSM '07**

- Biomechanical effects of dynamic ER on rotator cuff repair
- 6 matched cadavers – single row fixation
- Cyclic loading with & without ER
  - Anterior tendon gap formation was greater with end range ER (30° of ER)
  - Strain on posterior tendon was less with ER

**REHABILITATION FOLLOWING ROTATOR CUFF REPAIR**

*Keys to Success*

- Controlled Stress can be Good!!!
  
  - “just be sure it’s controlled”
  - Be sure patient can tolerate it
  - Patient & Surgery variables
  - Light controlled motion assists in collagen synthesis & alignment
  - Immobilization – negative effects
  - Different rehab rates of progression

*Team Approach to Treatment - Individualize*

**Increasing Concerns Regarding ROM (PROM & AROM)**

**Which are safe exercises??**

*Importance of Post-

- Scar formation subacromial
- Capsular contracture
- Muscular atrophy
- Tissue degeneration - immobilization*
Dockery, Wright, LaStayo: Orthop '98

- 10 healthy male volunteers
- Mean age 18 to 33 yrs of age
- Surface EMG applied to shldr
- 7 post-op rotator cuff exercises performed:
  - Pendulum
  - Pulley
  - Self assisted bar with opposite arm
  - Self-assisted ER/IR
  - PROM
  - PROM ER/IR
  - CPM device
- Only “passive” – CPM & PT PROM

REHABILITATION FOLLOWING ROTATOR CUFF REPAIR

- Immediate PROM (restricted)
- Sling for 4-6 weeks
- Elbow/hand ROM & gripping
- Limited PROM for 4-8 weeks
- Limited based on:
  - Size of tear
  - Tissue quality
- Full PROM: 6-8 weeks (??)
- Goal: Healed Rotator Cuff Repair

Uhl et al: Phys Med & Rehab ‘10

- 12 different exercises:
  - Supine PROM opposite arm: Supra 1% Infra 4%
  - Table slide: Supra 5% Infra 2%
  - Wash cloth press up (AA): Supra 3% Infra 7%
  - Table towel slide (AA): Supra 7% Infra 4%
  - Step up with ball (Active): Supra 21% Infra 18%
  - Standing press-up: Supra 29% Infra 14%

Caution with long lever exercises & gravity
Restore Balance in The Shoulder
“Balance is the key”
• Capsular balance – joint play
• Soft tissue balance
• ER/IR unilateral muscle ratios
• ER/Abd unilateral ratios
• Stable base – scapulae - Foundation

“When in doubt go slow”

Team Approach to Treatment - Individualize

ER/IR Ratio

REHABILITATION FOLLOWING ROTATOR CUFF REPAIR

Keys to Success

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ER/Abd unilateral ratios
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REHABILITATION FOLLOWING ROTATOR CUFF REPAIR

Muscle Training Guidelines

Dynamic Stabilization Program
• Emphasize ER strength
• ER/IR ratio: 52% >
• Rhythmic stabs
  ➢ ER/IR drills
  ➢ Flex/Ext drills
  ➢ Progress to sidelying Flex RS

DYSFUNCTIONAL ARC
Shoulder Shrug

• Rotator cuff dysfunction
• Inability to dynamically stabilize
• Arc of motion (0-30) (90-145)
• Dysfunctional arc ~30-90 degrees
• Superior humeral head migration “shrug sign”
RHYTHMIC STABILIZATION
Rotator Cuff Dysfunction

- Supine ↔ sidelying
- Isometric (RS) ↔ isotonic
- Sidelying short arc isotonics 0-120/145°

REHABILITATION FOLLOWING ROTATOR CUFF REPAIR
Muscle Training Guidelines

- “light” muscle re-education
  To prevent muscular inhibition
  “muscle shutdown”
- Isometrics – subpainful & submax
- Electrical Muscle Stim
- Rhythmic stabs ER/IR & F/E
- Scapular strengthening wk 2
- Tubing ER/IR wk 4
- Side-lying flexion wk 6

Progress resistance 1 lb. per week
Gradually load the repair site – stress/response
Electrical Stimulation - Shoulder
Reinold, Macrina, Wilk: AJSM '08

- 39 RTC repair patients
  - Mean 10 ± 7 days s/p
  - Range 2-19 days
  - Mean age 54 (23-76 yrs)
- Peak force of ER
- Significantly greater force w/ NMES
  - 3.27 kg with NMES
  - 2.49 kg without NMES
  - > 22% increase
  - No difference based on age, size of tear, days postop, or STIM intensity

Gradual return to function
“Sometimes slower is better”
✓ Depends on functional demands
✓ Depends on who they are
✓ Depends on unique surgery factors
✓ Depends on numerous factors
  ✓ life’s situation (care giver)
  ✓ patient’s with physical limitations

Team Approach to Treatment - Individualize

Aquatic Rehabilitation - UE
**REHABILITATION FOLLOWING ROTATOR CUFF REPAIR**

*Type II – Functional Activity Guidelines*

- No heavy lifting for at least 6 months
- Physician will determine!!!!
- May perform some restricted weight lifting activities close to body
- Sport activities (interval programs):
  - Golf week 14-16
  - Tennis week 22-26
  - Swimming week 24-26

**Manaka, Ito, Matsumoto, et al: CORR ’11**

- Functional recovery following rotator cuff repair (Japanese Orthop Assoc scoring syst.
- 201 patients underwent arthroscopic repair
  - 31% took less than 3 months
  - 40% took between 3 & 6 months
  - 28% took more than 6 months
- Age, shoulder stiffness & cuff tear size influenced functional recovery time

**Reflections – Outcome Data**

“Nothings ruins a good outcome like long term follow-up studies”

- Bring people back and assess them
- Make changes based on your outcome data
- It’s all about function & pain & longevity with a rotator cuff repair

Evidence Based Treatment - Outcomes

**Wilk: Tech Shoulder & Elbow Surg ’00**

- 22 patients, mini-open repair
- Average follow-up 40 months
- Average age 64.7 years (range 40-76)
- Size of tear:
  - 1 small, 9 medium, 8 large, 4 massive
- 95% excellent/good results (ASES)
- Average score (ASES)
  - pre-op 30.7 vs. post-op 92
  - ADLs pre-op 3.25 vs. post-op 18.8
  - 4 patients received MRI – 1 failure (excellent result)

**REHABILITATION FOLLOWING ROTATOR CUFF REPAIR**

*Keys to Success*

- Is slower better?
- When in doubt – go slow!
- Better is:
  - Individualized
  - Adjustable
  - Gradual
  - Progressive
  - Supervised
- Team Approach is Critical – Communications is the key

Summary - Key Points
<table>
<thead>
<tr>
<th>REHABILITATION FOLLOWING ROTATOR CUFF REPAIR</th>
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<tbody>
<tr>
<td><strong>Summary - Key Points</strong></td>
</tr>
<tr>
<td>• Must have different rehabilitation programs</td>
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<td>• One program does not accurately fit all pts</td>
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<tr>
<td>• Individualize the program to a degree:</td>
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<tr>
<td>✓ Calcific tendonitis repair</td>
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*This patients may require more attention*